DIVISION OF
OIL & GAS
DNR
INDIANA
DEPARTMENT OF NATURAL RESOURCES

Spill Management Guide

Handling oil and saltwater spills in Indiana

Published 1/19/2001

Table of Contents

Spill Management Guide

Chapter 1 Introduction

Purpose

Each state manages spills of oil and saltwater at regulated facilities in a different manner. However, the concepts and methodologies used to mitigate spill damage are very similar. This document is a guide for persons who are responsible for handling oil and saltwater spills at facilities regulated by the Indiana Department of Natural Resources, Division of Oil and Gas. It is designed to supplement the rules governing spill response (312 IAC 16-5-22 through 29). Although the guide is not a step-by-step manual, the information it contains can be used to help the reader report spills and develop, implement and monitor a spill management program.

Spill management protocol

Managing oil and saltwater spills requires the application of a multi tiered approach designed to minimize soil and water contamination. This approach has 3 primary components:

1. Spill reporting
2. Spill containment
3. Spill cleanup

Spill reporting

An owner or operator of a facility regulated by the Division of Oil and Gas must report any discharge of oil or saltwater to appropriate state authorities as specified in Table 1 (See Chapter 3 Spill Reporting). The reporting requirement creates a permanent record of spill events and is used to insure that spill response efforts are properly monitored by the regulatory agency that has authority over the spill.

Spill containment

One of the most critical tasks in any spill response effort is to contain the spill to minimize damage to the environment. Containment techniques may include methods such as trenching, vacuum truck removal of free liquids, booming of water and use of absorbent materials to prevent spill migration. Step by step use of spill containment methods is not covered in this guide. However, Chapter 4 contains several scenarios that may help you decide the best method for containing a spill.

Spill cleanup

Once a spill has been contained you can begin the process of remediating the spill. Under the provisions of 312 IAC 16-5 there are several methods that can be employed to clean up a spill. Spill cleanup is a somewhat predictable yet inexact science that is affected by several factors.

These factors include soil type and hydraulic conductivity, distance to groundwater, relationship to surface water, distance to drinking water wells, volume of affected material, initial relative concentration of contaminants to soils, biologic organism considerations and soil chemistry. Each of these factors is covered in greater detail in Chapter 5.

Chapter 2 Jurisdiction

The Division of Oil and Gas regulates activities associated with the exploration for and production of oil and gas resources under the authority of the Indiana Code (IC 14-37). Regulation of oil and gas activities is conducted through the implementation of the Indiana Administrative Code (312 IAC 16-5). The rules governing oil and gas exploration and production contain requirements for the management of oil and saltwater spills (312 IAC 16-5-22 through 29). In addition to the division's authority to regulate oil and gas operations, the Indiana Department of Environmental has authority to regulate spills under the Indiana Code (IC 13).

Releases of oil that harm fish, wildlife or botanical resources are also governed by the Indiana Department of Natural Resources, Division of Fish and Wildlife. For more information about this program contact the Indiana Department of Natural Resources, Division of Fish and Wildlife, Environmental Coordinator at (317) 232-6528

Jurisdiction over spills is also vested in the federal government under the Clean Water Act. This act requires the reporting of discharges of oil in harmful quantities to navigable waters.

Based upon a Memorandum of Agreement dated 5/13/1997, the Indiana Department of Natural Resources and the Indiana Department of Environmental Management agreed to coordinate the regulatory response to spills of oil and saltwater from facilities regulated by the Division of Oil and Gas. This agreement led to the joint development of a rule under the division's authority. The rule received final approval by the Natural Resources Commission on June 21, 2000 and was published in the Indiana Register in November, 2000. Elements of this rule include definitions, spill containment, spill reporting, spill cleanup, remediation of soils contaminated with oil, remediation of soils contaminated with salt water, disposal, monitoring and spill cleanup reporting.

Federal, state and local agencies all have a stake in the management of spills. The spill responder should, therefore, take great care to handle spills through the application of best management practices.

Chapter 3 Spill Reporting

Responsibility

The responsibility for reporting an oil or saltwater spill rests with the owner or operator of the facility where the spill originated. Determining which agency receives the spill report is related to the quantity, location and containment of the spill.

Important: The owner or operator of the facility where the spill originated is responsible for filing a report with the appropriate agency or agencies.

State Reporting

The following table should be used to decide which agency you must notify in the event of a spill.

Table 1
State Spill Reporting Requirements

Size and location of the spill	Report the spill to	
	Indiana Department of Natural Resources (812) 477-8773	Indiana Department of Environmental Management (317) 233-7745 or (888) 233-7745
> 2000 gallons of oil or saltwater inside an approved secondary containment structure	Within 48 hours after discovery of the spill	
> 1000 gallons of oil or saltwater not inside an approved secondary containment structure		Within 2 hours after discovery of the spill
< 1000 but more than 42 gallons of oil or saltwater not inside an approved secondary containment structure but inside the facility	Within 48 hours after discovery of the spill	
> 55 gallons of oil not inside the facility		Within 2 hours after discovery of the spill
< 55 gallons of oil or saltwater not inside the facility	Within 48 hours after discovery of the spill	
Any spill of oil or saltwater in waters of the state.		Within 2 hours after discovery of the spill
Any spill of oil or saltwater not cleaned up or cleanup started per section 24		Within 2 hours after discovery of the spill
Any spill of oil or saltwater < 42 gallons not in waters of the state.	No report required.	

Federal reporting

In addition to the state requirements for spill reporting, the federal Clean Water Act requires the reporting of spills of oil in harmful quantities that enter water. The following guidelines apply to federal reporting of spills.

Coastal and inland waters

Coastal waters are the responsibility of the U.S. Coast Guard while inland waters fall within the jurisdiction of the USEPA. Regardless, calling the National Response Center at (800) 424-8802 can satisfy the reporting requirement for a spill into either type of water**.** Spills must be reported as soon as you have knowledge of the spill.

Federal lands

Spills in quantities of more than 10 barrels, or less in sensitive areas, that occur on federally owned land must be reported to the Bureau of Land Management (BLM) and also to the surface managing agency. The Hoosier National Forrest is an example of the type of federal land that requires a spill report to the BLM

Information requirements

When filing a spill report with the state reporting agency noted in Table 1, you must provide specific information related to the spill. Consequently, you should take the time to prepare the information in advance of contacting the agency to facilitate the report. The following information should be prepared before calling the agency:

1. The name, address and telephone number of the person making the report
2. The name, address, and telephone number of a contact person, if different than the person making the report
3. The location of the spill including lease name, township, range and section
4. The time of the spill
5. The identification of the substance spilled
6. The approximate quantity of the substance that has been spilled or may be spilled
7. The duration of the spill
8. The source of the spill
9. The name and location of waters damaged (if any)
10. The identity of any response organization responding to the spill
11. What measures have been or will be undertaken to perform a spill response
12. Any other information that may be significant to the response action.

Hint: Use the Spill Report Form in Appendix A to help you collect the information noted above

Chapter 4 Spill Containment

Purpose

One of the most important steps that can be taken following the discovery of a spill is to prevent the migration of the spilled material. By preventing contaminants from entering "waters of the state" you can decrease the chances that the spill will be regulated by more than one state agency. Additionally, preventing migration can decrease the total amount of affected area and lower cleanup costs. Timely and effective spill containment sends the message that you care about the environment and will do what it takes to protect natural resources.

Methods

The methods used to contain a spill are dictated by several factors:

1. Volume of spilled material
2. Location of the spill
3. Rate of movement
4. Spilled material (oil Vs saltwater)
5. Type of affected media (soil, vegetation, water)
6. Dynamic of spill (ongoing or stopped)
7. Availability of spill containment equipment and materials

For obvious reasons it would be very difficult to combine all of the possible factors noted above into a cookbook approach to spill containment. However, several of the most likely scenarios can be projected.

Small oil spill in soil

Small spills in soil are the most likely type of spill to occur in the oilfield. Depending upon volume, distance to water and soil matrix, many of these spills require little or no containment. Spills of less than forty-two gallons such as those commonly experienced from stuffing box leaks and small pipeline holes are often not even discovered until a routine check of a facility is performed. Where containment is required for such spills the method most often used is to apply straw to absorb the liquid. In addition to straw there are commercial materials that are capable of absorbing oil in soils. These types of products prevent migration by binding the oil to the soil. The contaminated soil and absorbent materials should then be collected and disposed of properly. In some cases the absorbent material is so effective in capturing the oil and binding it into an inert matrix that removal is not required. Note: Whether or not the spill requires containment, spills of more than forty-two gallons must still be reported to the appropriate agency per Table 1 (See Chapter 2)

Small oil spill in water

Small spills in water can often be handled by using absorbent booms that are petroleum preferential. These booms will absorb the oil without picking up water. Once the booms have absorbed all of the oil or have reached their oil saturation capacity they must be removed and disposed of properly. Note: Regardless of the volume and whether or it can be contained, spills that enter "waters of the state" must reported to the Indiana Department of Environmental Management at (317) 233-7745 or (888) 233-7745

Large oil spill in soil

Spills that can be measured in barrels are more likely to migrate and pose the greatest risk to the environment. Consequently, these spills must be contained more aggressively. If the spill is located in an area where there is little or no topographic relief it may be sufficient to use straw or other materials to absorb the spill. However, in cases where the spill is migrating you will need to actively prevent movement of the spill. This can often be accomplished by placing barriers in the path of the spill that will collect the liquids. The spill can then be removed for storage and disposal. A proper barrier may consist of something as simple as a shallow excavation that is designed and placed so that the spill is collected.

Important: Before excavating, evaluate the depth to groundwater to insure that oil does not enter water.

Large oil spill in water

Large spills in water present special problems because they are more difficult to trap and have the potential to cause significantly greater environmental damage. Consequently, rapid response using appropriate equipment is of paramount importance. These spills fall within the jurisdiction of the Indiana Department of Environmental Management. Therefore, specific guidelines related to spill management should be obtained from IDEM.

Regardless of jurisdiction you should use the following immediate response guidelines:

1. **Act as quickly as possible. (Do not delay taking containment action while evaluating the overall problem)**
2. **If the spill is from an ongoing leak, as soon as possible, stop the leak at the source.**
3. **Prevent the spilled material from entering surface or ground water.**
4. **Set booms as close to the water entry point of the spill as possible.**
5. **Set additional booms as far downstream as needed to collect as much of the oil as feasible.**
6. **Do not use oil dispersants in water unless authorized to do so by IDEM.**

Saltwater spill in soil

Most saltwater spills in soil are rapidly absorbed into the shallow subsurface. Therefore, it is unlikely that there will be any free liquids to collect. However, this does not mean there is no containment strategy for such spills. Depending upon the amount of the spill it may be possible to collect the spill by trenching down gradient from the spill. This technique may be effective if the spill is of recent origin and there is sufficient fluid flow in the subsurface to cause the saltwater to flow into the trench. In the absence of natural fluid flow the use of fresh water flushing to facilitate fluid movement can be an effective means of both moving the saltwater and diluting its effect on the soil.

When constructing a trench system, you should keep in mind that its purpose is to collect and hold fluids. Therefore, you should make sure that it is capable of holding fluids and has a fluid removal system in place to avoid further migration.

Important: Do not flush the soils with fresh water until you have measured the sodium level and, as needed, applied a soil amendment to prevent soil dispersion.

Hint: See Appendix C, Worksheet 3 for amendment information.

Saltwater spill in water

As you might expect, spills of saltwater into surface water are extremely difficult to manage. Since the medium for both materials is the same there is little that can be done to prevent spill migration. The key to spills that have the potential to reach water is to use all available means to stop them before they reach water.

Chapter 5 Spill Cleanup

Spill cleanup can be divided into 3 categories depending upon the nature of the spill:

1. Oil
2. Saltwater
3. Oil and saltwater

Oil Spills

After a spill has been contained and reported the next phase of a spill response is to conduct a cleanup. The cleanup phase can be broken down into several critical steps:

1. Site assessment
2. Remediation selection
3. Remediation implementation
4. Sampling and analysis

Site assessment

The evaluation of a site is the first step that must be taken before any cleanup strategy can be implemented. The purpose of the evaluation is to determine which cleanup option(s) are best suited to the site. While this may seem a simple matter there are a variety of factors that affect the remediation method you select.

1. Slope of the site
2. Likelihood of flooding
3. Soil type and permeability
4. Depth to ground water
5. Geographic extent of the spill (Contained with the facility boundary?)
6. Distance to surface water, field tile systems and water wells

Slope of the site

Slopes greater than 6% are considered to steep for on site remediation of spills. This would preclude the use of bioremediation unless the contaminated soils are removed from the site and transferred to an area with a lower slope.

Flooding likelihood

Sites that are subject to flooding, whether frequent or occasional, are not suited for on site bioremediation of spills because of the risk that oil could enter "waters of the state". For the same reason any spill site that is located in a flood plain or a floodway as defined by 310 IAC 6-1-3 or in a wetland as defined by the U.S. Fish and Wildlife Service cannot be managed with an on site bioremediation.

Soil type and permeability

Soils that are hydric or water bearing in nature are unsuitable for on site bioremediation. Also, soils with a very low organic content tend to be less capable of supporting the bioremediation process without significant organic amendment. Consequently, very sandy soils are more difficult to manage in a bioremediation process than loamy soils.

The permeability of a soil relates to its capability to transmit fluids through the soil matrix. This factor, coupled with the depth to ground water can render a site unfit for bioremediation. Further information on this is shown in Table 2 below.

Depth to ground water

Coupled with soil permeability, the depth to ground water is a significant factor in making a determination of remediation methodology. Under the requirements of 312 IAC 16-5-25 sites with specific combinations of soil permeability and depth to ground water have specific requirements for using on site bioremediation. The table below shows the criteria that must be used to evaluate these factors.

Table 2
Bioremediation Availability
Based on Soil Permeability and Depth to Ground Water

Permeability and Depth to Ground Water	Remediation Requirements
More than 2.0 inches/ hour permeability and Less than 6 feet depth to ground water	On site bioremediation not permitted
More than 2.0 inches/ hour permeability and More than 6 feet depth to ground water	On site bioremediation permitted using a liner [1]
Less than 2.0 inches/ hour permeability and Less than 6 feet depth to ground water	On site bioremediation permitted using a liner [1]
Less than 2.0 inches/ hour permeability and More than 6 feet depth to ground water	On site bioremediation permitted without a liner

The specifications for permeability and depth to ground water shown in the table must be based on the Soil Survey prepared for the county by the Natural Resources Conservation Service or by an on-site inspection and analysis by a qualified soil scientist or licensed professional geologist.

[1] Liner requirements

Synthetic liners

- *Constructed of a minimum of 20 mil polyethylene or its equivalent*
- *Hydraulic conductivity of 1 x 10^{-6} centimeter per second or less*
- *Installed in accordance with the manufacturers directions*
- *Equipped with a leachate collection system that collects all leachate from the remediation site for monitoring and proper disposal*
- *Installed at least 2 feet above the depth of ground water*

Compacted soil liners

- *Constructed of soil compacted to a depth of 2 feet*
- *Hydraulic conductivity of 1×10^{-6} centimeters per second or less*
- *Installed at least 2 feet above the depth of ground water*

Location of the spill

On site bioremediation means that the entire spill site must be within the boundary of the facility. If the amount of contaminated material outside of the facility boundary is small and you obtain permission from the adjacent landowner, you may move the contaminated materials onto your facility so that bioremediation can be conducted. In the absence of this consent you may conduct bioremediation on the contaminated soils within your facility boundary but must use other remediation/ disposal options for the off site materials.

Distance to surface water and water wells

On site bioremediation must be conducted in a manner that prevents the migration of contamination into any "waters of the state". The following are a minimum set of distance requirements designed to insure that contamination does not reach water:

1. No part of the bioremediation site may be within 100 feet of any surface water or field tile
2. No part of the bioremediation site may be within 1500 feet of any public water supply well
3. No part of the bioremediation site may be within 500 feet of any domestic water well
4. No part of the bioremediation site may be within a wellhead protection area that is delineated and approved in accordance with rules of the Water Pollution Control Board for the State of Indiana at 327 IAC 8-4.1

Remediation selection

After you have conducted a site assessment and reviewed outside factors such as cost/ benefit and remediation feasibility it is time to select a remediation option. For oil spills there are 2 available options.

1. Bioremediation
2. Material disposal/ interment

Bioremediation

The best way to manage a spill is to completely remove it from the environment. Bioremediation accomplishes this by taking advantage of natural biological processes that degrade petroleum. Additionally, it also conserves soil resources. Therefore, bioremediation is the preferred method of site remediation where the site evaluation allows it to be used.

Many species of microbes, fungi and algae have the ability to metabolize, or eat, oil. The byproducts of this metabolic process are carbon dioxide, water and fatty acids. These compounds are non-toxic. The process is governed by several factors such as temperature, nutrition, hydration, aeration and pH of the soil. In addition to native populations several varieties of engineered/ commercial microbes are available. Although many of these strains of microbes have been specifically designed to prefer certain petroleum products the addition of microbes to native soils is usually unnecessary and may in fact not be as effective in metabolizing oil in the field environment. The reason for this seemingly contrary result is that native populations exhibit a tolerance for their environment that engineered microbes do not. This makes native populations heartier.

Regardless of whether or not you add microbes, every bioremediation process requires a generally accepted set of criteria to be successful. The criteria that most affect the process are:

1. Temperature
2. Moisture
3. Nutrition
4. Aeration
5. Soil pH

<u>Temperature</u>

All organisms have a preferred temperature range within which they function most efficiently. This is as true of microbes as it is of humans. Studies have shown that the optimum operating soil temperature range for the organisms that metabolize oil is between 40 and 90° F. Below 40° the metabolic functions of microbes slow to levels that make the processing of hydrocarbons more inefficient. Conversely, soil temperatures above 90° can be lethal to microbes. Therefore, the best period to accomplish bioremediation occurs between April and October when the lower end of the nighttime temperature range stays high enough to prevent the soil temperature from dropping below 40°. However, during the summer months when air temperatures can exceed 90° for several days in a row or sites are subjected to extensive periods of direct sunlight it is advisable to monitor soil temperature to insure that the high end of the optimum range is not exceeded.

Hint: Soil temperature can be easily measured using either a fluid filled or digital soil thermometer.

Moisture

All living things need water to survive. The amount of water required during the bioremediation process varies but a range of 40 to 80% is recommended. Most of the time normal precipitation should be adequate to maintain this range. However, if the area experiences much lower than average rainfall during summer months, additional watering of the site may be required. Note: If soil moisture drops below 40% the efficiency of the bioremediation process may be seriously compromised.

Soil moisture can usually be measured in the field since the accuracy of the moisture measurement is not as critical to the success of the bioremediation project as other elements such as pH. Consequently, a rough estimation is usually sufficient.

Hint: Electric and dielectric soil moisture meters provide an adequate reading of soil moisture.

Nutrition

The ability of organisms to metabolize oil depends upon the efficiency of their cellular functions. These functions are greatly influenced by the levels of Nitrogen and Phosphorus in the environment. Microbes require Nitrogen, primarily in the form NH_4, for the construction of nucleic acids and proteins while Phosphorus is used to synthesize phospholipids and nucleic acids. Consequently, environments poor in either Nitrogen or Phosphorus provide inadequate material for proper cellular function. A good objective in bioremediation is to maintain a N:P ratio of about 5:1. Maintenance of this ratio is as much art as science. However, there is a rule of thumb application ratio for inorganic fertilizer that should provide the desired results. By applying fertilizer at a Nitrogen: Phosphorus: Potassium ratio of about 4:1:1 you should be able to maintain an appropriate balance of nutrients. To supply sufficient nutrients and maintain the nutrient balance the recommended application rate for fertilizer per 100 square feet of contaminated soil is:

1. 0.25 lbs. Nitrogen
2. 0.06 lbs. Phosphorus
3. 0.06 lbs. Potassium

Important: The fertilizer used to treat the affected area must not contain biocides, fungicides or herbicides as these constituents would be lethal to the microbes and would terminate the bioremediation process.

Aeration

Many of the microbes that degrade oil in soils require oxygen to function. The most cost effective and efficient way to provide oxygen is by tilling the soil. Periodic tilling affects the bioremediation process in 2 ways:

1. By thoroughly mixing the soils with the nutrients, pH modifiers and contaminants you achieve a more uniform mixture; and
2. By tilling the soils to a depth of between 4 and 12 inches you loosen the soil matrix, allowing more oxygen to reach the microbes. This promotes more rapid growth of microbe colonies and enhances the bioremediation process.

Soil pH

Microbes are sensitive to changes in soil chemistry. The pH of soil is, therefore, an important consideration in the bioremediation process. Ideally a pH of between 6 and 8 is recommended.

Hint: Oil has a tendency to lower soil pH while brines tend to raise pH.

Important: In cases where oil is the principal contaminant you should not use saltwater to raise the pH as the Sodium component in saltwater can actually be lethal to the microbes.

Prior to adding anything to the soil the pH should be measured. If the pH is greater than 8 the additions of agricultural grade lime may be needed. If the pH is lower than 6, adjustments to the nutrient proportions may be required. If you are unsure of the proportions of pH adjustment material to use try experimenting on a small plot and then expanding the proportions to fit the entire affected area. Important: When attempting to adjust the pH upward through the use of nutrient changes take care not to overload the soil with specific nutrients so that the nutrient ratio is adjusted too far outside of the recommended N:P:K ratio of 4:1:1.

Soil pH can be measured by using a pH test kit, an electronic pH meter, or in a laboratory. Soil pH kits and meters can be purchased at most chemical supply companies.

Important: When using a test kit or meter, make sure to follow the directions precisely so that an accurate reading is obtained.

Monitored natural attenuation

Since microbial reduction of petroleum is a natural process, the degradation of oil occurs to some extent irrespective of human intervention. Consequently, the decision to allow oil-contaminated soils to remediate themselves naturally is a valid bioremediation option. However, when making such a decision it is critical to evaluate each situation on its own merits. For example, if the level of oil contamination is significant it may not be possible to lower the contaminant level below the required minimums within a reasonable period of time. Secondly, just allowing a site to self-remediate does not mean that you have no further obligations to meet. You must still monitor the spill site in accordance with 312 IAC 16-5-28 (See Appendix D), test it for PAH contamination, prevent contaminated material from migrating and submit the required reports. Additionally, if the site does not meet minimum contaminant levels within 365 days from the date you discovered the spill, you may be required to either perform more active bioremediation or implement a disposal and soil replacement program for the site.

Active bioremediation

Active bioremediation involves the use of soil amendments, tilling, watering (if needed) and monitoring to effectively remove oil contamination from soils. The following is a guide to selecting and implementing an active bioremediation.

Conduct a site evaluation as noted above to determine if on-site bioremediation is a viable option. If bioremediation is allowed steps 1-20 below are recommended, otherwise go to step 21.

Bioremediation implementation

1. If bioremediation is acceptable complete the Cost Analysis Worksheet (See Appendix A forms) to determine if bioremediation is the most cost effective remediation method.
2. If bioremediation is the remediation selection you choose follow steps 3 through 21, otherwise go to step 22.
3. Obtain a representative sample of the contaminated soil and have it analyzed for PAH content using the method specified in 312 IAC 16-5-25 (See Appendix D)
4. Submit a copy of the PAH analysis and a Spill Report to the Division of Oil and Gas.
5. Determine soil pH and as needed apply soil amendments to adjust to a pH of between 6 and 8.
6. Apply a $N:P_2O_5:K_2O$ fertilizer at the rate of 0.9 lbs. N, 0.6 lbs. P_2O_5, and 0.6 lbs. K_2O per 100 square feet of contaminated area.
7. Disk the soil to a depth of between 4-12 inches.
8. Water the soil as needed to attain moisture content of between 40 and 80%.
9. If the soil will support plants re-vegetate the site to prevent erosion and enhance the bioremediation process. ***Hint: Some perennial grasses can grow in soils that contain more than 3% oil by weight***
10. If the site has not been planted with vegetation, re-disk the soil to between 4 and 12 inches at least once every 3-4 months during the bioremediation process.
11. After 365 days analyze a representative sample of the contaminated soil for PAH's using the same method noted in item 3 above.
12. If PAH's are below the limits shown in Table 3 of 312 IAC 16-5-25 the project is considered complete.
13. File a copy of the PAH analysis and a final Spill Report with the Division of Oil and Gas.
14. If PAH's **are not** below the limits shown in Table 3 of 312 IAC 16-5-25 (See Appendix D) the project is not considered complete.
15. File a copy of the PAH analysis and a project update on a Spill Report with the Division of Oil and Gas.
16. Upon acceptance of the plan detailed in the update on the Spill Report, implement the plan.
17. After the time period specified in the plan, analyze a representative sample of the contaminated soil for PAH's using the same method noted in item 3 above.
18. If PAH's are below the limits shown in Table 3 of 312 IAC 16-5-25 (See Appendix D) the project is considered complete.
19. File a copy of the PAH analysis and a final Spill Report with the Division of Oil and Gas.
20. If PAH's **are not** below the limits shown in Table 3 of 312 IAC 16-5-25 (See Appendix D) the project is not considered complete.
21. File a copy of the PAH analysis and a project update on a Spill Report with the Division of Oil and Gas.
22. Go to the Material disposal/ replacement section below.

Important: You must determine whether or not the oil spill is associated with saltwater before implementing an active bioremediation program because salts must be removed from the contaminated soil before the program will be effective.

Hint: The success of any remediation project depends upon the care taken to determine the remediation variables, select an appropriate remediation method, implement a remediation plan and evaluate the results.

Material disposal/ replacement

Although bioremediation, whether natural or active, is the preferred method for managing contaminated soil, it is not always acceptable or cost effective. Sometimes it is better to excavate and dispose of contaminated soils. For example, if the Cost Analysis worksheet indicates that active bioremediation may be more costly than disposal you may chose to excavate and replace the contaminated soil without ever attempting bioremediation. However, this requires you to:

1. Excavate the contaminated soil
2. Remove the contaminated soil from the facility
3. Dispose of the contaminated soil in accordance with 329 IAC 10-8.1-13 in a municipal solid waste landfill permitted by the Indiana Department of Environmental Management.
4. Replace the excavated soil with comparable uncontaminated soil

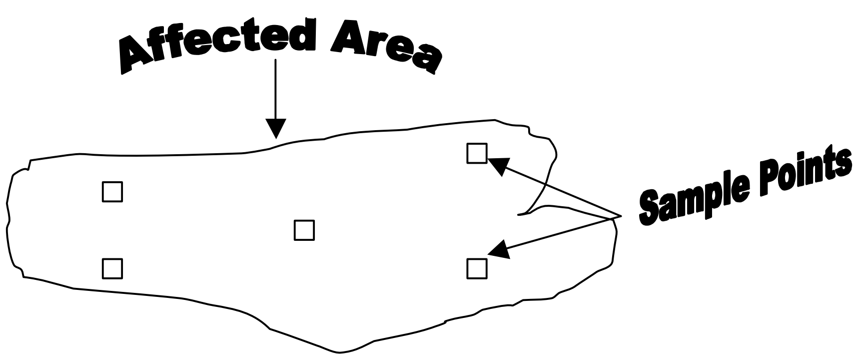
Based on the above requirements, however, you can see that cost is not the only factor to consider when choosing a remediation option.

Sampling and Analysis

Insuring tests of contaminated soil yield accurate data is critical to the successful conclusion of a bioremediation project. Invalid sample analyses can result in the premature termination of a bioremediation project. This could lead to increased costs for additional analyses or disposal. Therefore, it is very important for samples to be collected, handled, transferred, and analyzed properly. This section will detail the requirements for collecting and analyzing samples so valid results can be obtained.

Sample collection

Collecting a representative sample is the first step in the sampling and analysis process. In order for a sample to be representative it should contain a cross section of the contaminated soils. This can be accomplished by collecting a soil sample from 0 to 4 inches deep at several points within the contaminated site using a pattern similar to the one in the following diagram.



Hint: A non-plated stainless steel bulb planter that is decontaminated between each sampling point by washing with soapy water and rinsing with distilled water makes a good tool because it collects a sufficient sample at a suitable depth.

After collecting a sample at each of the points the samples should be thoroughly mixed in a stainless steel or glass bowl. A single sample from the resultant mixture should yield a sample that is representative of the entire contaminated site.

Important:

- ***Make sure you store the samples only in glass containers with non-plastic (i.e. Teflon®) lids so the sample is not contaminated.***

- ***Soil samples should be kept cooled to 39°F during the storage and transport process to insure the validity of the analysis results.***

In many cases the laboratory conducting the analysis will provide the correct type of sample container. While it is acceptable to use containers other than those provided by a laboratory, it is very important that they are either sterilized, or washed with mild soapy water and rinsed with distilled water before being used to hold samples.

Sample handling and transfer

Each composite sample should be labeled so that it can be referenced to the appropriate contamination site.

Hint: Use waterproof markers and fill in the labels before sticking them to the jars.

Once a sample is labeled it should be logged on a Chain of Custody form (See Appendix A). The Chain of Custody provides a record that shows a sample was in the possession of the person who collected it until it was transferred to the laboratory. While this may seem unnecessary it can be vitally important if the integrity of the sample is ever questioned in court. Insuring a proper chain of custody can make the difference between a valid and an invalid sample.

Samples are sometimes split so that a third party can conduct in independent analysis. When this is done the split should come from the original composite sample you have collected.

Important: Do not collect a second composite sample and offer that as a split.

Whenever you split a sample with someone make sure they sign a Receipt of Samples form (See Appendix A)

Once a sample is collected in the field it should be taken to the laboratory as soon as practical. In most cases samples can be taken to the lab by the sampler. In some cases, however, it is necessary to mail the sample. When mailing samples you should make sure the sample bottles are placed in a properly cushioned container. The Chain of Custody form should be placed inside and the shipping container should be sealed with strong tape to prevent tampering.

Hints:

- ***An insulated hard plastic cooler makes a good container for holding, transporting and mailing soil samples to the lab because it helps maintain the temperature and is durable.***

- ***If you must mail the samples to the lab, place packets of dry ice inside the cooler to insure temperature control***

- ***Mark the container* Fragile Glass Inside**

Sample analysis

The analysis request to the laboratory lists the analyses requested for the sample. In the case of the PAH analysis for oil contaminated soils, the analysis request should indicate that the analysis should show the results in parts per million (ppm) for the following PAH's:

Acenaphthene
Anthracene
Benzo(a)anthracene[2]
Benzo(b)fluoranthene[2]
Benzo(k)fluoranthene[2]
Benzo(a)pyrene[2]
Chrysene[2]
Dibenz(a,h)anthracene[2]
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene[2]
Napthalene
Pyrene

Important: The laboratory you chose should have a valid Quality Assurance/ Quality Control Plan in effect.

Saltwater Spills

Spills of saltwater present problems that are significantly different than those posed by oil spills. Saltwater spills tend to have two primary effects. Total salt concentrations effect plant growth and Sodium concentrations can damage soil structure. Unlike oil, which tends to become more immobile in soils, saltwater tends to travel rapidly through soils. The cleanup methods used on saltwater contaminated soils vary from those used for oil contaminated soils in several respects. However, as with oil spills, the cleanup phase can still be broken down into several critical steps:

1. Site assessment
2. Sampling and analysis
3. Remediation selection
4. Remediation planning
5. Implementation and monitoring

Site assessment

Evaluating the site is the first step that must be taken before any cleanup strategy can be implemented. The purpose of the evaluation is to determine which cleanup option(s) are best suited to the site. The factors being evaluated include the following:

1. Slope of the site
2. Soil matrix and chemistry
3. Depth to ground water
4. Level and age of contamination

Slope of the site

The slope of a site must be considered before implementing a remediation option. In order for in-place soil amendments to work the soil must remain in place. At slopes greater than 8%, erosion of the soils can make soil amendment a poor remediation choice. In such situations it may be necessary to utilize some form of erosion control prior to implementing any on-site remediation. Examples of some effective erosion control measures include berming, mulching, terracing, leveling, contour tillage and netting. In the absence of erosion controls the use of mechanical remediation techniques such as excavation and disposal, on-site burial and either on-site or off-site soil washing may be required to effectively remediate the contaminated soil.

Soil matrix and chemistry

The physical and chemical composition of the soil into which saltwater has been spilled plays a significant role in the remediation process. In highly impermeable soils the level of penetration may be low enough to allow the saltwater to pool on the surface. If a spill is caught early enough in such situations, it may be possible to collect the free liquids measure the Sodium levels, apply soil amendments and flush the site with fresh water to return the soils to a near pre-spill condition. More permeable soils will tend to allow fluid migration to occur much more rapidly. In highly permeable soils the contaminants may actually migrate downward to the point where they are not visible at the surface.

In addition to the permeability of the soils, the chemical character of soils also plays a major role. For example, soils with high clay content tend to capture and hold the positively charged ions (cations) such as Sodium due to their relatively large amount of negatively charged surface area. The presence of these cations in saltwater is the main cause of damage to soils. Therefore the amount of clay minerals in the soil may dictate the level and type of remediation possible at a contaminated site.

One of the principal problems associated with the presence of high levels of Sodium in soils is known as dispersion. In normal clayey soils the electrochemical balance between particles is maintained and soil particles tend to aggregate or clump together providing space (called macropores) through which air and water can move. In sodic soils (soils with a sodium absorption ratio > 13) an electrochemical imbalance takes place, which causes the particles to repel one another. This dispersion of particles tends to fill the macropore space between particles. This closes off the soil matrix to air and water transmission. Without the ability for air and water movement through macropores, the process of leaching cannot take place. This causes the sodium to remain in the shallow soil zones. However, it should be noted that the dispersion process does not take place until the site has been exposed to enough fresh water to cause the Sodium to displace the more abundant cations in the soil matrix.

Important: Before you apply fresh water to any saltwater spill in soil you should determine the sodicity of the soil. In highly sodic soils you must apply soil amendments to counter the dispersion effect that would occur when fresh water is applied. The application of these amendments cannot be overemphasized.

Important: If the affected soil is high in Boron, the fresh water used to flush salt affected soil should be free of excessive Boron. Amounts as small as a few grams per cubic meter of Boron can be toxic to most crops.

Soil pH affects the remediation process because pH plays a major role in determining which chemical amendment is best for releasing Sodium from the soil. The soil pH/ amendment relationship can be broken down into 3 categories:

1. Neutral pH (5.5 to 8.5)
2. High pH (greater than 8.5)
3. Low pH (less than 5.5)

Neutral pH

A pH of between 5.5 and 8.5 is considered neutral with respect the choice of soil amendment. In a neutral pH soil you can typically use either gypsum or a combination of Calcium Chloride and Calcium Nitrate to release exchangeable Sodium from the soil. Each of these materials has specific advantages and disadvantages. While gypsum is lower in cost it requires the application of as much as 1 foot of fresh water for each 10-tons/ acre of gypsum application. Thus a shortage of available fresh water may limit its use. A Calcium Chloride/ Calcium Nitrate combination is more expensive and has the risk of adding Chlorides to a soil already contaminated by Chlorides. However, it requires less fresh water application and acts faster than gypsum to release the Sodium. Therefore, the choice of Sodium release soil amendment in this situation depends upon the cost, water availability, level of Chloride contamination in the soil and the target date for completion of remediation.

Important: The use of Calcium Nitrate should be closely monitored to insure that its application does not result in an increase in Nitrate levels in groundwater above the maximum allowable level of 10 mg/L.

High pH

In alkali soils it may be advisable to apply a combination of gypsum with aluminum sulfate, iron sulfate.

A laboratory can calculate the amendment ratio so that the amount of gypsum to co-apply with sulfur, for example, is known prior to the application.

Low pH

Acidic soils can be amended with lime, crushed limestone or dolomite. However, the amount of lime needed to raise the pH level to 7.0 may not supply enough calcium to release the necessary amount of Sodium from the soil. Therefore, a supplementary application of gypsum may be required to insure proper Sodium release.

Hint: Regardless of which soil amendment strategy is selected you should always keep the pH needs of the expected vegetation in mind. If the vegetation you have chosen to plant functions better in soil of lower or higher pH you will want to carefully select soil amendments that work to release Sodium without adjusting the pH outside of the plants growth preference range.

Depth to ground water

When conducting a site assessment prior to making a remediation option decision, knowing the depth to groundwater is essential (See Appendix C, Worksheet 4). In areas where shallow or perched water tables exist you must weigh the relative risk to ground water posed by the leaching of contaminants that would occur during an on-site remediation Vs the cost of performing an excavation and soil replacement. If the ground water is naturally saline or brackish, the introduction of additional salts may not adversely affect the nature of the water. However, when making this assessment you must consider existing state laws and rules related to the protection of ground water.

Important: If ground water can be negatively affected by on-site remediation the excavation and replacement option should be used.

Level, frequency and age of spill

The remediation option chosen also depends upon the level, frequency and age of contamination. The amount of damage sustained by a soil can be greatly affected by these factors. For example, a soil that has experienced multiple applications of saltwater accumulates Total Dissolved Solids in its matrix. The accumulation progressively degrades the soil and makes in-place remediation more difficult to achieve. The age of the contamination also effects in-place remediation because as a spill ages the amount of soil damage increases. Also, as a spill ages the contaminants tend to move downward thus making them less available to the effects of soil amendments.

Sampling and analysis

As with oil-contaminated sites the importance of a properly executed sampling program cannot be overestimated. The principal difference is that a sampling and analysis program for saltwater contaminated soils **must** be conducted prior to the implementation of a remediation option. As described in the site assessment section above, level of contamination and soil chemistry are critical to the selection, design and implementation of an appropriate remediation option.

There are 2 principal ways to determine the level of soil salinity at a site:

1. Electromagnetic field measurement
2. Physical soil sampling and analysis

Electromagnetic field measurement

This type of measurement also referred to as an EM reading, is obtained by using an Electro Conductivity Meter (EM meter) such as a Geonics Limited Model EM38® to indirectly measure the soil conductivity (EC) in the field. This type of meter is capable of measuring EC to a depth of up to 60 inches. The meter provides a display of EC in milliSiemens per meter (mS/m). Since the EM meter measures only soil conductivity it cannot be used to develop a remediation plan on sites where high sodium is the main problem. Another drawback EM measurement is the lack of a simple formula for converting EM readings into salinity in either deciSiemens per meter (dS/m) or its functional equivalent, millimhos per centimeter (mmho/cm). However, since EM equipment can be used to characterize a site with a large number of readings in a relatively short amount of time it can often provide an excellent overall site profile and can assist you in laying out a sampling pattern.

As noted above, the EM meter provides a reading of soil conductivity. Unfortunately, salt tolerance in plants is a function of water conductivity. Therefore, several factors such as soil moisture, clay content and soil temperature play a significant role in the correlation between an EM reading and the salt tolerance of plants. (McKenzie, George, Woods, Cannon and Bennett, 1997) suggest that the variation in soil temperature can be accounted for through the application of a relatively simple formula that references the approximately 2 percent increase in conductivity that occurs per degree increase in temperature. However, even after temperature is eliminated as a variable, we are left with a 2 variable conversion that can be difficult to calculate.

Important: Due to the complexity of converting EM readings to a value which can be correlated to plant salt tolerance, it is recommended that EM readings should be coupled with soil sampling to provide a more balanced and accurate representation of salinity.

Physical soil sampling and analysis

Taking a physical sample of contaminated soil provides you with a more complete picture of soil characteristics. Physical sampling can provide you with measures of soil and water salinity, sodicity, pH, clay percentage, organic content and moisture level. The factors measured from a physical sample were previously discussed. However, some of the benefits and limitations of physical sampling and analysis are:

- It can provide water salinity making plant selection more precise
- It is cost effective if a minimum number of samples is needed
- It is effective for characterizing small areas of contamination (less than 100-sq. ft.) and sites with uniform levels of contamination.
- It provides the capability of measuring a broad range of characteristics
- It is cost prohibitive for large numbers of samples
- It can be time and labor intensive
- It should be conducted by someone familiar with sampling protocols
- It is less useful in characterizing larger sites or sites with variable levels of contamination.

Remediation selection

After you have reviewed the previous sections it is time to select a remediation option. Based upon the site review and spill characteristics there are 4 potential remediation methods from which you can select (See Appendix C, Worksheet 1 for guidance):

1. Natural attenuation
2. In-situ amendment and planting
3. Mechanical remediation and planting
4. Excavation/ replacement and planting

Natural attenuation

This option is appropriate **ONLY** when **ALL** the following conditions are met:

- The spill is small (less than 42 gallons)
- The spill is not a repeat occurrence on the same soil
- There is no threat of spill migration into water
- Present and future projected plant affect is minimal
- Soil permeability and depth to ground water are within the guidelines for bioremediation specified in Chapter 5 Table 2.
- The soil matrix is principally sandy OR the spilled fluids were not high in Sodium
- The Total Dissolved Solid content of the spill was relatively low

If all of the above are satisfied, the site is likely to be better off if left to natural recovery processes. However, in cases where one or more of the above cannot be met or determined, one of the following options would be a better choice.

In-situ amendment and planting

This option takes advantage of the principals of chemical bonding, which allow the percolation of water through the soil layer to transmit salts away from the root zone.

Important*: *Since the ultimate goal is to remove the salts by shifting them to zones below the root zone it is critically important to verify that the depth to ground water is not shallow enough to capture and transmit the salts and chemical amendments.

Adding soil amendments, while a theoretically simple process, can be complex. In order to determine which amendments or amendments is suitable you must take into account factors such as soil matrix, release time, alkalinity of the soil, toxicity and moisture need.

Hint: You can use the worksheet in Appendix C entitled Chemical Amendments Indicators for Salt Affected Soils to evaluate which amendment combination would work for your particular situation.

Mechanical remediation and planting

Mechanical remediation refers to a group of remediation technologies that rely on physical rather than chemical methods to remove the salts from soil. These methods include measures such as tilling, tiling, excavation and treatment, and even soil mixing. Soil washing is an example of a mechanical method that, while more expensive than in-situ remediation, is preferable in certain cases. Land spreading is another example of a mechanical remediation option that can lower the overall affect of salt damage.

Important: Make sure that the contamination level in the affected soil is not so high that spreading it out may simply create a larger affected area.

Excavation/ replacement and planting

In some cases it can be more cost effective and beneficial to simply remove contaminated soil from the site and replace it with uncontaminated soil that is capable of supporting vegetation. This method may be preferable where the amount of material is small (which keeps costs down) or the contamination level is very high (which makes the success of other remediation methods unlikely).

Regardless of the remediation option selected it is important to manage soil erosion to prevent the migration of contaminated soils. While there are several methods that can be used to accomplish this task, re-vegetation is probably the best. It tends to be easier to accomplish, is lower in cost and is likely to be more permanent in nature.

Hint: To select vegetation for planting based on salinity, see the document in Appendix B entitled Salt Tolerance of Herbaceous Crops (After "Remediation of Salt-Affected Soils at Oil and Gas Production Facilities", API publication number 4663, 1997). Also, never plant a species without first determining whether or not it is acceptable under any regulatory requirements. For further information about the introduction of non-native plant species please contact the Indiana Department of Natural Resources, Division of Entomology and Plant Pathology at (317) 232-4120

In addition to deciding which option is most appropriate, you must also decide which option you can implement and monitor. The issues of implementation and monitoring are often times related to factors outside of the "most appropriate" decision making process. These factors include cost, level of expertise and time availability. Prior to making a remediation selection you should evaluate these factors to insure that the remediation program will have the highest chance to succeed.

Hint: You can use the worksheet entitled Cost Analysis from Appendix C to help you conduct a cost comparison of remediation options.

Planning

After you have selected a remediation option you should develop a plan to implement that option in the field. A properly designed plan will provide you with a step-by-step guide to performing a remediation. The plan should include information about the equipment, supplies and staff time needed to remediate the site.

Implementation and monitoring

After you have prepared a plan you must implement it and monitor the results to insure that the remediation is proceeding correctly. The best way to accomplish this is to periodically sample and analyze the soils and check the growth of vegetation. Remember, the ultimate goal is to remediate the site. Do not get hung up on analysis results, and scientific methodology. Decreases in contaminant level are important but they are not the only measure of accomplishment. If the site is accepting appropriate vegetation and you are preventing off site migration of contaminants your project may be succeeding even though a lab analysis indicates contamination is still present.

Important: Before beginning any remediation effort in salt affected soils, it is critical to understand the dynamics involved. Consequently you should review the information contained in "Remediation of Salt-Affected Soils at Oil and Gas Production Facilities", API publication number 4663, 1997 to assist you in developing, implementing and monitoring a remediation program that has the best chance of succeeding in the field.

Chapter 6 Site closure

Evaluation

Before a site can be considered closed it must be evaluated to determine if the remediation plan was successful. Although it is advisable for you to monitor the site periodically during the remediation process it is not required by rule. However, the post remediation evaluation of the site will determine whether or not the division will require additional remediation. Consequently, if you have conducted periodic evaluations, you will be in a much better position to determine whether or not the site can be expected to meet the post remediation requirements for closure before you perform the final site evaluation.

To properly evaluate a site you must:

1. Sample and analyze the soils
2. Conduct a visual inspection of the site
3. Determine if the site needs to be re-graded
4. Determine if there is a need to plant or re-plant vegetation to control erosion
5. Determine if additional or alternate remediation methods should be used

Sample and analyze soils

In the case of an oil spill the soils must meet a predetermined level of post remediation contamination. This level is specified in attached Indiana Administrative Code 312 IAC 16-5-25 Table 3.

Conduct a visual inspection

Even though the sample analysis may indicate that the soil contamination has been reduced to an acceptable level it is still important to consider the esthetic qualities of the site. A site that appears contaminated may meet the requirements of the regulatory agency but may still present a perceptual problem. Additionally, if you used technologies such as bio piling or bio-cell construction you will need to dismantle these structures and return the previously contaminated soil to its original location. Therefore, the site cannot be released until it has been returned to as near the pre-spill condition as practicable.

Evaluate the need to grade the site

Proper grading will insure that the topography of the site is consistent with the surrounding area. In addition, grading will make the planting of vegetative cover easier to accomplish. In cases of soils that were salt affected to the point where they will not support vegetation, site-grading designs such as terracing and berming can be used to prevent soil erosion. However, your should talk with the landowner before implementing such grading options to insure that grading will not adversely affect the area surrounding the site.

Evaluate the need to plant or re-plant vegetation

Unless the site has already been planted in crops it may be necessary to plant an acceptable form of vegetation to prevent erosion. Care should be taken to plant a form of vegetation this is consistent with the surrounding vegetation and is neither obnoxious nor intrusive. Even in areas where salt affected soils prevent planting of most crops it is still possible in many cases to plant vegetation that will protect the soil from erosion while maintaining the vegetative character of the surrounding area. To review your choice of vegetative cover please see the previous chapter.

Evaluate the need for additional or alternate remediation

At times it becomes apparent that the remediation option you selected is not effective. At these times it is necessary to evaluate whether there is a need for additional remediation or, in some cases, selection of another remediation method to replace the current program. The current remediation program should be viewed with a critical and objective eye. If it is clear that assisting the current process it is not likely to achieve remediation, it is time to consider alternative methods. Conversely, if progress is being made but the site requires additional active assistance, you may want to consider additional soil amendments, tilling, alternate vegetative covers or even microbial addition.

Hint: You could avoid costly and time-consuming effort if you view the site with a critical and objective eye.

Reporting

After evaluating the site you must submit a report using the form entitled Spill Report in Appendix A. The division uses this report to evaluate the need for additional remediation and to determine the final closure status of the site. After reviewing the report, the division will send you a letter indicating whether or not the site can be considered closed.

Chapter 7 Review

Reviewing the information in this manual can assist you in insuring that the best possible outcome is achieved.

Chapter 1introduced the concept of spill management including the need to report, contain and cleanup spill spills and spill contaminated soils

Chapter 2 was devoted to the divisions' legal jurisdiction over spill management

Chapter 3 provided you with a guide to the reporting requirements related to spills of oil or saltwater at facilities for which you are responsible. You can likely meet your state reporting responsibilities by following the table shown in this chapter.

Chapter 4 presented you with a set of scenarios you are likely to encounter in the field and the methods you can use to contain spills. In most cases, following these guidelines will prevent additional environmental harm and could lower your overall spill response and cleanup costs.

Chapter 5 is an in depth guide to spill cleanup including the factors involved in determining which method of cleanup to use, a guide to how clean is clean, guidance on conducting an on-site bioremediation project, and the differences between oil and saltwater spill remediation.

Chapter 6 tells you what must be accomplished before a site can be considered closed including what must be done to evaluate site cleanup effectiveness and how to report this information to the division.

Disclaimer: This manual is designed to provide guidance on spills. However, it has not been tested under field conditions. While we recommend using the manual as a general guide, the Division of Oil and Gas does not warrant it for either accuracy or efficacy. Therefore, reliance on the manual does not automatically absolve responsible parties from meeting the requirements of state or federal laws with respect to the reporting, containment or cleanup of spills.

Appendix A Forms

This manual contains the following forms:

Form Title	Form No.	Used for
Spill Report	R12	1. Gathering the information that must be reported to a regulatory agency 2. Filing a written report of a spill to the Division of Oil and Gas 3. Reporting remediation progress and site closure
Chain of Custody	G12	Recording the chain of custody between the sampler and the laboratory
Receipt of Samples	G13	Recording the receipt of samples by a laboratory or individual (For example, this form would be used to record the receipt of a sample split)
Sample Tag	G14	The sample tag used to mark individual samples (This form should be attached to the sample jar)

Important: Some forms are optional and some are required. You should refer to the manual text to determine the nature of the form you are using

Spill Report Form

SPILL REPORT

Form No. R12
Revised on 9/5/2000

INDIANA DEPARTMENT OF NATURAL RESOURCES
Division of Oil and Gas
402 W. Washington St., Rm 293
Indianapolis, IN 46204
Phone (317) 232-4055
FAX (317) 232-1550
Internet: http://www.state.in.us/dnroil

FOR DIVISION USE ONLY	
Approved for extension until:	Approved by:
Approved for closure on:	Approved by:

PART I	**GENERAL INFORMATION**			
Name of reporting party	Telephone Number ( ) -	Spill ID Number		
Name of lease	County	Township	Range	Section
Type of submission (Check one only)	☐ Initial report (Complete PART II a thru g)	☐ Status report (Complete PART II h)		
Name of spill responder (If different than reporting party)	Telephone Number ( ) -			

PART II **SPILL INFORMATION**

a. Type and volume (Check all that apply)
☐ Oil ________ gallons ☐ Saltwater ________ gallons

b. Duration ________ Hours or Days or Weeks (Circle one of the above)

c. Source (Check all that apply)
☐ Wellhead (Permit) ________ ☐ Secondary containment overflow/ failure ☐ Impoundment overflow/ failure ☐ Flowline

d. Is the spill inside the containment dike? ☐ No ☐ Yes (Describe the methods used to contain the spill)

____

____

e. Did any of the spill enter water?
☐ No ☐ Yes Name of water body ________________

f. Did more than 55 gallons of the spill leave the lease?
☐ No ☐ Yes

g. Can the spill be remediated in place?
☐ Yes (Review the Spill Management guide to develop and implement a remediation plan)
☐ No (Can the material be removed to another part of the lease? If Yes proceed as above, if No follow the requirements of 312 IAC 16-5-27 concerning disposal of the material)

h. Did the site reach remediation requirements within 365 days of remediation implementation?
☐ Yes (Attach copy of sample analysis)
☐ No (Attach copy of sample analysis and propose further remediation efforts and expected compliance date below)

____

____

PART III **AFFIRMATION**

I (we) affirm under penalty of perjury that the information provided in this form is true to the best of my (our) knowledge and belief.

Signature of responsible party of authorized agent	Date signed

Chain of Custody Form

Form No. G12

I certify that the samples listed below were collected by me or in my presence.

Signature: ____________________ Date: _____________ Project Code: ________________

Lab Number Adssigned	Control Number	Site Number	Number Of Containers	Type Of Container	Samplers Initials	Date Collected and Time Sealed

I certify that I received the above samples

Signatures	Date & Time	Seals Intact		Comments
Relenquished by: _______________ Received by:	________	Yes	No	________________________________
Relenquished by: _______________ Received by:	________	Yes	No	________________________________
Relenquished by: _______________ Received by:	________	Yes	No	________________________________
Relenquished by: _______________ Received by:	________	Yes	No	________________________________

I certify that I received the above samples. After recording these samples in the official record book, these samples will be in the custody of competent laboratory personnel at all times or locked in a secured area.

Signature ____________________________ Date _____________ Time ___________

Lab __________________________ Address ____

Sample Tag Form

Receipt for Samples

Form No. G12

Name of Facility	Project Code
Facility Location (TWP, RGE, Sec. 1/4, 1/4, 1/4 & footages)	

Sample No.	Description of Sample (Amount, type, container, & storage specs.)

Transferred by: (Signature)		Received by: (Signature)	
Transferred by: (Printed Name)		Received by: (Printed Name)	
Title	Date Signed / /	Title	Date Signed / /

Reminder: Use waterproof marker to complete the Sample Tag and fill it out before affixing it to the sample jar

Receipt of Samples Form

Receipt for Samples

Form No. G12

Name of Facility	Project Code
Facility Location (TWP,RGE,Sec. 1/4,1/4,1/4 & footages) ____	

Sample No.	Description of Sample (Amount, type, container, & storage specs.)

Transferred by: (Signature)		Received by: (Signature)	
Transferred by: (Printed Name)		Received by: (Printed Name)	
Title	Date Signed / /	Title	Date Signed / /

Appendix B References

API. 1997. *Remediation of Salt-Affected Soils at Oil and Gas Production Facilities*. API Publication Number 4663, Washington D.C.

Beyrouty, C.A[1]., Reynolds, C.M[2]., Rogers, H.B[1]., Nichols, T.D. [1], and Wolf D.C[1]. Date unknown. *Plant and Microbial Influence on Bioremediation of Hydrocarbon -Contaminated Soils*. [1]University of Arkansas, Fayettville, Arkansas, [2]U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire

Davis, K.L. 1995. *A comparative Cost Analysis of Petroleum Remediation Technologies.* Third International In Situ and On-Site Bioreclamation Symposium, San Diego, California

Davis, K.L. etal. 1995. *A Comparative Cost Analysis of Petroleum Remediation Technologies.* Third International In Situ and On-Site Bioreclamation Symposium. San Diego, California

Deuel, Lloyd E. 1991. *Evaluation of Limiting Constituents Suggested for Land Disposal of Exploration and Production Wastes*. API Publication Number 4527, Washington D.C.

Dickey, Parke A. 1986. *Petroleum Development Geology, Third Edition*. PennWell Publishing Company, Tulsa Oklahoma.

Hoffman, Glenn J. Date unknown. *Guidelines for Reclamation of Salt-Affected Soils*. U.S. Salinity Laboratory, U.S. Department of Agriculture, Riverside, California.

ICF Resources, Inc. June, 1993. *Oil and Gas Exploration and Production Waste management: A 17 State Study.* U.S. Department of Energy and Interstate Oil and Gas Compact Commission contract DE-AC01-91FE62017, Task 10, Washington DC

Lesch, Scott M.., Rhoades, James D., and Corwin, Dennis L. January, 2000. *The ESAP-95 Version 2.01R User Manual and Tutorial Guide.* U.S. Salinity Laboratory, U.S. Department of Agriculture, Riverside, California

Maas, E.V. Date unknown. *Salinity and Crop Productivity.* U.S. Salinity Laboratory, U.S. Department of Agriculture, Riverside, California.

McMillen, S.J. etal. 1995. *Assessing Bioremediation of Crude Oil in Soils and Sludges*. Third International In Situ and On-Site Bioreclamation Symposium, San Diego, California

Nickolaus, Michael P. January, 1999. *A regulatory Perspective of the Remediation of Crude Oil and Saltwater Contaminated Soils*. Indiana Department of Natural Resources, Division of Oil and Gas

Ohio Department of Natural Resources, Division of Oil and Gas. 1997. *Bioremediation of Crude Oil Spills A Non-Technical Field Guide.*

Oster, J.D. and Frenkel, H. 1980. *The Chemistry of the Reclamation of Sodic Soils with Gypsum and Lime*. Soil Science Society of America- Journal, Volume 44 No 1, Madison, Wisconsin.

Otten, James K., Asher-Bolinder, Sigrid, Owen, Douglass E., and Hall, Laurel. July 1997. *Effects of produced water at some oilfield production sites in southern Illinois, Preliminary Open File Report 97-448* U.S. Geological Survey, Denver, Colorado

Pal, D. and Overcash, M.R. 1978.*Plant-Oil Assimilation Capacity for Oils.* 85th National Meeting of American institute of Chemical Engineers

Rhoades, J.D.. Date unknown. *Electrical Conductivity Methods for Measuring and Mapping Soil Salinity.* U. S. Salinity Laboratory, U.S. Department of Agriculture, Riverside, California

Scalzi, Michael. 1999. *Bioremediation can produce predictable, reproducible results.* Soil and Groundwater Cleanup.

Shawnee Resource Conservation & Development Area, Southeast Illinois Brine Damage Task Force. Date unknown. *Oil Brine Damage*.

Suarez, D.L. Date unknown. *Estimating Soil Solution Composition for Reduced Leaching Management and Efficient Reclamation.* U.S. Salinity Laboratory, U.S. Department of Agriculture, Riverside, California

Appendix C Worksheets

The following worksheets may be used to help you:

1. Estimate the feasibility of a chemical amendment or bio-remediation of spill affected soils
2. Determine the relative cost of remediation options
3. Determine which chemical amendments are best suited for use on salt affected soils
4. Determine if drainage problems exist on the site.

Worksheet 1
Chemical Amendment/ Bio-Remediation Feasibility

Site Characteristic	Yes	No	Explanation of Effect
If the potential for erosion is present can it be controlled?			In erosion prone areas it is difficult to plant and maintain vegetative cover and the likelihood for migration of soil amendments is greater. If the erosion potential can be managed a chemical amendment program is more likely to succeed.
Is the water table greater than 6 feet below surface?			If the answer to this question is NO you may not be able to remediate oil-affected soils on site. To review the requirements for oil contaminated soils refer to Chapter 5, Table 2 Bioremediation Availability
Is the EC < 425 mS/m as measured using an EM meter?			The level of residual salt contamination after a chemical amendment remediation has been completed directly affects the ability to re-vegetate a site. EM readings over 425 usually indicate very poor vegetative potential.
Is the root zone free of impermeable soil layers?			The release of salts from the root zone is essential to the long-term success of a remediation effort involving chemical amendments. Impermeable soil layers in the root zone trap salts making chemical amendments ineffective.
Does the site receive adequate natural watering?			The amount of rain Indiana receives is usually sufficient to hydrate biologic populations and promote sodium leaching. However, you should monitor precipitation conditions during remediation and irrigate the site as needed to maintain a soil moisture of between 40-80%
Does the soil contain less than 5%Total Petroleum Hydrocarbons?			At lower TPH levels the ability to reach acceptable PAH levels is enhanced. When higher levels of TPH are present, bioremediation can still succeed but may require more aggressive methods such as bio-piling, soil aeration, bio-cell construction or soil vapor extraction
If the pH is less than 5.5 or greater than 8.5, can it be adjusted?			pH outside of this range indicates a need to adjust pH prior to beginning a bioremediation. This would typically occur when dealing with a combined Oil/ Saltwater spill.

After FEASIBILITY OF CHEMICAL REMEDIATION Table A-3, API Publication 4663, 6/98

Important: If the answer to all questions in the worksheet is Yes, using a chemical amendment and re-vegetation approach on salt affected soils, or a bioremediation approach on oil affected soils is likely to work. Otherwise, you should refer to the other sections of this guide to determine which type of site remediation method is appropriate for the site.

***Worksheet 2**
Cost Analysis

Item	Unit Cost	Remediation Units	Disposal Units	Remediation Cost	Disposal Cost
Materials					
Fertilizer				$0	$0
Gypsum, Lime, chemicals				$0	$0
Erosion control (Straw, netting, etc...)				$0	$0
Mulch (Straw, sawdust, peat)				$0	$0
Replacement topsoil				$0	$0
Seed				$0	$0
Supplemental fresh water				$0	$0
Other				$0	$0
Equipment					
EM meter				$0	$0
Sample containers				$0	$0
Sampling equipment				$0	$0
Tilling equipment				$0	$0
Trucks				$0	$0
Water truck				$0	$0
Trachoe				$0	$0
Bulldozer				$0	$0
Backhoe				$0	$0
Other				$0	$0
Contract Services/ Administration					
Site evaluation				$0	$0
Excavation				$0	$0
Hauling				$0	$0
Grading				$0	$0
Tilling equipment				$0	$0
Laboratory testing				$0	$0
Site monitoring				$0	$0
Project documentation				$0	$0
Soil interment				$0	$0
Other				$0	$0
Total Estimated Costs				**$0**	**$0**

This worksheet was modeled after the Cost Analysis Worksheet, Ohio Department of Natural Resources, Division of Oil and Gas, "*Bioremediation of Crude Oil Spills A Non-Technical Field Guide*", 1997.

Instructions:

1. If you are using the electronic version of this guide double click on the worksheet to enter data in the Excel spreadsheet, otherwise print the worksheet then enter and calculate the data manually.

2. If an item is not required for a particular option enter 0 in the Units column for that option.

3. The cost of each item should be calculated for both options

Important: Any item may have a cost under each option. For example the cost of Site monitoring may be $0 for the disposal option but the cost of Laboratory testing may be greater than $0 for either option because bioremediation requires sampling while landfills may also require a laboratory analysis before accepting contaminated materials.

Worksheet 3
Chemical Amendment Indicators for
Salt Affected Soils

Chemical Amendment	Functions	Advantages	Application Method	Usage precautions	Use Y or N
Aluminum sulfate	Sodium displacer	Rapidly develops	Surface broadcast	Can be toxic to plants if application	
	Soil acidifier	soil micropores	and incorporate	lowers soil pH below 5	
	Drainage enhancer				
Calcium carbonate	Sodium displacer	Works well in	Surface broadcast	Will not work in alkaline soils	
	Soil alkalizer	acidic soils			
	Calcium supplier				
Calcium chloride	Sodium displacer	Fast acting	Dissolve in water and	Presents risk of ground water	
	Calcium supplier		surface apply	contamination	
Calcium hydroxide	Sodium displacer	Fast acting and works	Surface broadcast	Will not work in alkaline soils,	
	Soil alkalizer	well in acidic soils	and incorporate	can burn skin and eyes, is reactive	
				with water and can cement soils	
Calcium nitrate	Fertilizer	Fast acting and enhances	Surface broadcast	Presents risk of ground water	
	Sodium displacer	bioremediation and	and incorporate OR	contamination and is toxic	
	Calcium supplier	plant growth	Dissolve in water and	to some animals	
	Nitrogen supplier		surface apply		
Calcium oxide	Sodium displacer	Fast acting and works	Surface broadcast	Will not work in alkaline soils,	
	Soil alkalizer	well in acidic soils	and incorporate	can burn skin and eyes, is reactive	
				with water and can cement soils	
Diammonium phosphate	Fertilizer	Supplies Nitrogen and	Surface broadcast	Presents risk of ground water	
	Sodium displacer	Phosphate to plants	and incorporate	contamination due to high	
	Soil binder			solubility	
Displacer polymers	Drainage enhancer	Fast acting	Surface broadcast or	Cannot be used where soil cannot	
	Aggregate stabilizer		surface spray then	dry after application	
			allow to dry		
Dolomite	Soil alkalizer	Works well in acidic soils	Surface broadcast	Will not work in alkaline soils	
	Sodium displacer	and provides Magnesium			
	Calcium supplier	to plants			
	Magnesium supplier				
Gypsum	Sodium displacer	Releases slowly and	Surface spread then	Requires post application watering	
		provides long term benefits	till	to achieve desired effect	
Iron sulfate	Soil acidifier	Provides Iron and Sulphate	Surface broadcast	Quantity of application must be	
	Drainage enhancer	to plants	and incorporate	determined by titration	
	Sodium displacer				

Important: Gypsum should be co-applied with all amendments.

After CHEMICAL AMENDMENTS USED TO REMEDIATE SALT AFFECTED SOIL Table K-1, API Publication 4663, 6/98

Important: Place an* N *in the* Use (Y or N) *column where the Usage Precaution for any amendment indicates it should not be used on the site.

Hint: A combination of amendments usually works best. Application rates for each amendment must be based upon specific site conditions.

Worksheet 4
Drainage Evaluation

	Data:	**Criteria:**	**Interpretation**
Decision- Making Parameter	**Site Condition**	**Potential Drainage Problem if:**	**Drainage Problem (Y or N)**
Depth to seasonal high water table (groundwater or perched) in feet		**< 6 feet**	
Site often wet or in a delineated wetland *(Y or N)		**Y**	
Depth to impermeable layer, restrictive layer, or bedrock from 0-6 feet		**< 6 feet**	
Hydraulic conductivity of most restrictive lay from 0-6 feet		**< 0.2 inches/ hour**	
Shrink-swell potential (low/ moderate/ high)		**High**	
Cumulative determination based on all evidence	**N/A**	**Any of above**	

After WORKSHEET 2- DRAINAGE, *Remediation of Salt-Affected Soils at Oil and Gas Production Facilities, API Publication No. 4663, October 1997*

Most responses for this worksheet can be obtained from the Soil Survey prepared for the county by the Natural Resources Conservation Service or from an on-site inspection and analysis by a qualified soil scientist or licensed professional geologist.

Delineated wetland refers to an area defined by the U.S. Fish and Wildlife service or the U.S. Army Corps of Engineers

Important: If a cumulative evaluation of the site indicates a drainage problem, in-situ chemical remediation will probably result in long-term failure unless you concurrently improve the drainage.

Appendix D “Spill Rule”

312 IAC 16-5-23 Spill reporting
Authority: IC 14-37-3
Affected: IC 14-37

Sec. 23. (a) An owner or operator shall report all spills of oil or saltwater as required by Table 1 as follows:

Table 1. Spill Reporting Requirements		
Size and Location of the Spill	Report the Spill to the:	
	Indiana Department of Natural Resources	Indiana Department of Environmental Management
More than 2,000 gallons of oil or saltwater that is contained in a secondary containment structure approved by the Department of Natural Resources.	Not more than 48 hours after discovery of the spill.	
More than 1,000 gallons of oil or saltwater that is not contained in a secondary containment structure approved by the Department of Natural Resources.		Not more than 2 hours after discovery of the spill.
Less than 1,000 gallons but more than 42 gallons of oil or saltwater that is not contained in a secondary containment structure approved by the Department of Natural Resources but is contained within the boundary of the facility.	Not more than 48 hours after discovery of the spill.	
More than 55 gallons of oil that is not contained within the boundary of a facility.		Not more than 2 hours after discovery of the spill.
Less than 55 gallons of oil or saltwater that is not contained within the boundary of a facility.	Not more than 48 hours after discovery of the spill.	
Any spill of oil or saltwater that enters waters of the state.		Not more than 2 hours after discovery of the spill.
Any spill of oil or saltwater:		Not more than 2 hours after discovery of the spill.

(1) that has not been cleaned up in accordance with section 24 of this rule; or		Not more than 2 hours after discovery of the spill.
(2) for which cleanup has not been started in accordance with section 24 of this rule.		Not more than 2 hours after discovery of the spill.
Any spill of less than 42 gallons of oil or saltwater that does not enter waters of the state.	No report required.	

(b) Spills required by Table 1 to be reported to the Indiana department of natural resources must be reported to the Evansville field office by telephone at (812) 477-8773, or by facsimile at (812) 477-8952.

(c) Spills required by Table 1 to be reported to the Indiana department of environmental management must be reported to the office of environmental response at (317) 233-7745 or (888) 233-7745 (toll-free in Indiana).

(d) Each report of a spill must include all of the following information:

(1) The name, address, and telephone number of the person making the report.
(2) The name, address, and telephone number of a contact person, if different than the person making the report.
(3) The location of the spill, including lease name, township, range, and section.
(4) The time of the spill.
(5) The identification of the substance spilled.
(6) The approximate quantity of the substance that has been spilled or may be spilled.
(7) The duration of the spill.
(8) The source of the spill.
(9) The name and location of waters damaged.
(10) The identity of any response organization responding to the spill.
(11) What measures have been or will be undertaken to perform a spill response.
(12) Any other information that may be significant to the response action.

(Natural Resources Commission; 312 IAC 16-5-23; filed Sep 11, 2000, 3:31 p.m.: 24 IR 279; errata filed Dec 6, 2000, 10:12 a.m.: 24 IR 1032)

312 IAC 16-5-24 Spill cleanup
Authority: IC 14-37-3
Affected: IC 14-37

Sec. 24. (a) An owner or operator shall clean up spills of oil, fluids contaminated with oil, or saltwater as required by this section.

(b) Oil or fluid contaminated with oil that is confined within a secondary containment structure or collected as required by section 22 of this rule must be:

(1) removed within seventy-two (72) hours;
(2) placed in a nonleaking storage tank; and
(3) managed or disposed of in accordance with section 27(a) of this rule.

(c) Saltwater that is confined within a secondary containment structure or collected as required by section 22 of this rule must be:

(1) removed within seventy-two (72) hours;
(2) placed in a nonleaking storage tank; and
(3) disposed of in accordance with section 27(b) of this rule.

(d) Fluid placed in a nonleaking storage tank under subsection (b) or (c) must be disposed of in accordance with section 27 of this rule within thirty (30) days after discovery of the spill unless additional time is approved by the division.

(e) Soils contaminated with more than one (1) gallon of oil must be cleaned up as follows:

(1) Soils that meet the conditions for remediation in section 25(c) of this rule may be:

(A) remediated at the facility as required by section 25 of this rule;
(B) applied to lease roads in accordance with section 27(a)(1) of this rule; or
(C) excavated and disposed of as required by section 27(d) of this rule.

(2) Soils that do not meet the conditions for remediation in section 25(c) of this rule must be excavated and disposed of as required by section 27(e) of this rule.

(f) Soils contaminated with saltwater must be cleaned up as required by section 26 of this rule.

(g) Soils contaminated with oil that will be remediated under section 25 of this rule must be managed to prevent discharge of oil to unaffected soil or waters of the state. *(Natural Resources Commission; 312 IAC 16-5-24; filed Sep 11, 2000, 3:31 p.m.: 24 IR 280; errata filed Dec 6, 2000, 10:12 a.m.: 24 IR 1032)*

312 IAC 16-5-25 Remediation of soils contaminated with oil
Authority: IC 14-37-3
Affected: IC 14-37

Sec. 25. (a) The owner or operator may clean up soils contaminated with oil using remediation at the facility only as required by this section.

(b) The owner or operator may use a remediation method for soils contaminated with crude oil that is documented with a standard or procedure published by one (1) of the following:

(1) A department or agency of the federal government.
(2) A state environmental or natural resources agency.
(3) American Society for Testing and Materials.
(4) National Fire Protection Association.
(5) American Petroleum Institute.

(c) Remediation may be used at a facility only if all of the following conditions are met:

(1) Remediation is not prohibited by in subsection (e).
(2) The slope of the remediation site is less than six percent (6%).
(3) The remediation site is not:
(A) subject to frequent, common, or occasional flooding as described in the soil survey prepared for the county by the natural resources conservation service;
(B) located in a flood plain or a floodway as defined at 310 IAC 6-1-3; or
(C) a wetland.
(4) The surface soil at the remediation site is not classified as a hydric soil in the soil survey prepared for the county by the Natural Resources Conservation Service. Soil surveys are available from the Natural Resources Conservation Service, P.O. Box 2890, Washington, D.C. 20013; from the State Conservationist, 6013 Lakeside Boulevard, Indianapolis, Indiana 46278, (317) 290-3200 extension 301; or from the cooperative extension service office in the county.
(5) The entire remediation site is within the boundary of the facility.
(6) No part of the remediation site is within one hundred (100) feet of any surface water or field tile.
(7) No part of the remediation site is within one thousand five hundred (1,500) feet of any public water supply well.
(8) No part of the remediation site is within five hundred (500) feet of any domestic water well.
(9) No part of the remediation site is within a wellhead protection area that is delineated and approved in accordance with rules of the water pollution control board at 327 IAC 8-4.1.

(d) Contaminated soil that is not permitted to be remediated by in subsection (e) must be excavated and disposed of as required by section 27 of this rule.

(e) The remediation method to be used must be determined by the soil characteristics that exist at the remediation site as described in Table 2 as follows:

Table 2. Requirements for Remediation Based on Permeability of Surface Soil and Depth of Ground Water at the Remediation Site

Permeability[1] and Depth of Ground Water[1]	Remediation Requirements
More than 2.0 inches/hour permeability and	Remediation is not permitted.

Less than 6 feet depth to ground water	
More than 2.0 inches/hour permeability and	Use a liner that meets the requirements of subsection (f).
More than 6 feet depth to ground water	
Less than 2.0 inches/hour permeability and	Use a liner that meets the requirements of subsection (f).
Less than 6 feet depth to ground water	
Less than 2.0 inches/hour permeability and	No restrictions.
More than 6 feet depth to ground water	
[1]Permeability of surface soil and depth of ground water during the remediation as described in the soil survey prepared for the county by the Natural Resources Conservation Service or by on-site inspection and analysis by a qualified soil scientist or licensed professional geologist. Soil surveys are available from the Natural Resources Conservation Service, P.O. Box 2890, Washington, D.C. 20013; from the State Conservationist, 6013 Lakeside Boulevard., Indianapolis, Indiana 46278, (317) 290-3200 extension 301; or from the cooperative extension service office in your county.	

(f) If a liner is required by in subsection (e), remediation may be conducted on any site where one (1) of the following has been constructed:

(1) A synthetic liner that meets all of the following requirements:

(A) Constructed of a minimum of twenty (20) mil polyethylene or its equivalent.

(B) Hydraulic conductivity of 1×10^{-6} centimeters per second or less.

(C) Installed in accordance with the manufacturer's directions.

(D) Equipped with a leachate collection system that collects all leachate from the remediation site for monitoring and proper disposal.

(E) Installed at least two (2) feet above the depth of ground water.

(2) A compacted soil liner that meets all of the following requirements:

(A) Constructed of soil compacted to a depth of two (2) feet.

(B) Hydraulic conductivity of 1×10^{-6} centimeters per second or less.

(C) Installed at least two (2) feet above the depth of ground water.

(g) The owner or operator shall:

(1) begin remediation as soon as practicable but not more than one hundred twenty (120) days after discovery of the spill;

(2) notify the division within seven (7) days after beginning remediation;

(3) follow the remediation method or procedure selected as closely as possible;

(4) monitor the remediation site as required by section 28 of this rule during remediation; and

(5) complete remediation as described in subsection (h) within:

(A) three hundred sixty-five (365) days after beginning remediation; or

(B) another time period approved by the division.

(h) Remediation of soils contaminated with oil is complete when the concentration of polynuclear aromatic hydrocarbons in the soil is reduced to the values shown in Table 3:

Table 3. Criteria for Completion of Remediation of Soils Contaminated with Oil	
Contaminant	Maximum Concentration[1]
Acenaphthene	130 ppm
Anthracene	51 ppm
Benzo(a)anthracene[2]	5.0 ppm
Benzo(b)fluoranthene[2]	5.0 ppm
Benzo(k)fluoranthene[2]	39 ppm
Benzo(a)pyrene[2]	0.50 ppm
Chrysene[2]	26 ppm
Dibenz(a,h)anthracene[2]	0.5 ppm
Fluoranthene	880 ppm
Fluorene	170 ppm
Indeno(1,2,3-cd)pyrene[2]	3.0 ppm
Naphthalene	0.70 ppm
Pyrene	570 ppm
[1]The maximum concentration of polynuclear aromatic hydrocarbons in soil contaminated with oil is determined by testing a representative sample of that soil using U.S. EPA Method 8310, "Polynuclear Aromatic Hydrocarbons". Method 8310 is found in the U.S. Environmental Protection Agency Publication SW-846, Third Edition (November 1986), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", as amended by Updates I (July 1992), II (September 1994), IIA (August 1993), IIB (January 1995), and III (December 1996). U.S. Environmental Protection Agency Publication SW-846 is available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, (202) 512-1800.	
[2]This substance is a carcinogen identified in the RISC Technical Resources Guidance Document, Draft February 18, 1999.	

(i) If the contaminated soil does not meet the completion criteria in subsection (h) within:
(1) three hundred sixty-five (365) days after beginning remediation; or
(2) another time period approved by the division;
the owner or operator shall excavate all soil that does not meet the completion criteria in subsection (h) and dispose of that soil as required by section 27 of this rule. *(Natural Resources Commission; 312 IAC 16-5-25; filed Sep 11, 2000, 3:31 p.m.: 24 IR 281; errata filed Dec 6, 2000, 10:12 a.m.: 24 IR 1032)*

312 IAC 16-5-26 Remediation of soils contaminated with saltwater
Authority: IC 14-37-3
Affected: IC 14-37

Sec. 26. (a) The owner or operator shall clean up soils contaminated with saltwater using remediation at the facility only as required by this section.

(b) The owner or operator may use a remediation method for soils contaminated with saltwater that is documented with a standard or procedure published by one (1) of the following:
(1) A department or agency of the federal government.
(2) A state environmental or natural resources agency.
(3) American Society of Testing and Materials.
(4) American Petroleum Institute.

(c) Instead of using a method described in subsection (b), the owner or operator may submit to the division a written remediation plan that is designed to:

(1) prevent additional soil damage;
(2) prevent soil erosion;
(3) where feasible, remediate the soil to a condition where it can support vegetation;
(4) establish vegetative cover; and
(5) where feasible, use a vegetative cover with palatability and seasons of use characteristics similar to the vegetation already present on adjoining uncontaminated sites.

(d) If the division approves a remediation plan submitted under subsection (c), the owner or operator may use that approved remediation plan to clean up soils contaminated with saltwater at the facility. *(Natural Resources Commission; 312 IAC 16-5-26; filed Sep 11, 2000, 3:31 p.m.: 24 IR 282)*

312 IAC 16-5-27 Disposal
Authority: IC 14-37-3
Affected: IC 14-37

Sec. 27. (a) Oil or fluid contaminated with oil must be managed using one (1) of the following methods:

(1) Oil or fluid contaminated with oil may be applied to lease roads for the purpose of dust suppression in a manner designed to ensure that the materials do not leave the roadbed. Oil or fluid contaminated with oil must be:
  (A) stored in a leak-free tank; and
  (B) applied to lease roads within seventy-two (72) hours of removal from the secondary containment unless a longer period of time is authorized by the division.
(2) Oil or fluid contaminated with oil may be:
  (A) placed in a leak-free tank; and
  (B) returned to crude oil production in accordance with this article.
(3) Oil or fluid contaminated with oil may be disposed of in a solid waste land disposal facility if such disposal is approved by the Indiana department of environmental management.

(b) Saltwater or fluid contaminated with saltwater must be:

(1) injected into a Class II well authorized under 312 IAC 16-3; or
(2) discharged under a NPDES permit issued by the Indiana department of environmental management.

(c) Soil contaminated with oil or saltwater may be disposed of as alternate daily cover in a municipal solid waste landfill permitted under 329 IAC 10 in accordance with:

(1) 329 IAC 10-20-14.1; and
(2) the permit issued to the landfill under 329 IAC 10.

(d) After three hundred sixty-five (365) days of remediation, or another time period approved by the division, all soil contaminated with oil that has a remaining concentration of polynuclear aromatic hydrocarbons greater than the values listed in Table 3 in section 25(h) of this rule must be:

(1) excavated;
(2) removed from the facility;
(3) disposed of in accordance with 329 IAC 10-8.1-13 in a municipal solid waste landfill permitted by the Indiana department of environmental management under 329 IAC 10; and
(4) replaced with comparable uncontaminated soil.

(e) All soil contaminated with oil that is not permitted to be remediated under section 25 of this rule must be:

(1) excavated;
(2) removed from the facility;
(3) disposed of in accordance with 329 IAC 10-8.1-13 in a municipal solid waste landfill permitted by the Indiana department of environmental management under 329 IAC 10; and
(4) replaced with comparable uncontaminated soil.

(Natural Resources Commission; 312 IAC 16-5-27; filed Sep 11, 2000, 3:31 p.m.: 24 IR 283; errata filed Dec 6, 2000, 10:12 a.m.: 24 IR 1032)

312 IAC 16-5-28 Monitoring
Authority: IC 14-37-3
Affected: IC 14-37

Sec. 28. (a) The owner or operator shall monitor a remediation site for releases or discharges of oil or fluid contaminated with oil to surface waters as required by Table 4 as follows:

Table 4. Requirements for Monitoring a Remediation Site for Discharges to Surface Waters

Remediation Site Location	Type of Monitoring
More than 1,500 feet from surface water or field tile.	No requirement.
500 to 1,500 feet from surface water or field tile.	Once every 30 days, conduct a visual inspection during daylight hours of all surface water or field tile within 500 to 1,500 feet of remediation site for visible film, sheen, or discoloration of the surface of the water or sludge or emulsion beneath the surface or upon adjoining shorelines.
100 to 500 feet from surface water or field tile.	(1) Once every 7 days, conduct a visual inspection during daylight hours of all surface water within 100 to 500 feet of remediation site for visible film, sheen, or discoloration of the surface of the water or sludge or emulsion beneath the surface or upon adjoining shorelines. (2) If a visible film, sheen, or discoloration of the surface of the water or sludge or emulsion beneath the surface or upon adjoining shorelines is noted, sample any surface water within 100 to 500 feet from the remediation site and analyze the samples for violation of applicable water standards in 327 IAC 2, using a method described in 327 IAC 2.
Less than 100 feet from surface water or field tile.	Remediation is not permitted less than 100 feet from surface water or field tile.

(b) The owner or operator shall:
(1) record the date, time, and results of each monitoring event required by in subsection (a); and
(2) make the records available to the division upon request.

(Natural Resources Commission; 312 IAC 16-5-28; filed Sep 11, 2000, 3:31 p.m.: 24 IR 283; errata filed Dec 6, 2000, 10:12 a.m.: 24 IR 1032)

312 IAC 16-5-29 Reporting
Authority: IC 14-37-3
Affected: IC 14-37

Sec. 29. (a) The owner or operator shall report any discharge of oil from the remediation site that is required to be reported by 329 IAC 2-6.1 to the Indiana department of environmental management at (317) 233-7745 or (888) 233-7745 (toll free in Indiana).

(b) When remediation under section 25 of this rule is determined to be complete, the owner or operator shall send a written report to the division within seven (7) days of completion that includes the following information:
(1) The name and address of the person responsible for the remediation.
(2) The identity of the facility where the remediation was done.
(3) The type and approximate amount of the waste remediated at the facility.
(4) The method used to remediate the waste.
(5) The concentrations of polynuclear aromatic hydrocarbons listed in Table 3 in section 25(h) of this rule remaining in the soil at the remediation site.
(6) How the concentration of polynuclear aromatic hydrocarbons reported under subdivision (5) was determined.
(7) A copy of the laboratory report showing the concentrations of polynuclear aromatic hydrocarbons reported under subdivision (5).

(Natural Resources Commission; 312 IAC 16-5-29; filed Sep 11, 2000, 3:31 p.m.: 24 IR 284; errata filed Dec 6, 2000, 10:12 a.m.: 24 IR 1032)